City of Loma Linda Official Report

COUNCIL AGENDA: December 13, 2005

TO: City Council

VIA: Dennis R. Halloway, City Manager

FROM: W. James Hettrick, Director of Information Systems

SUBJECT: AWARD OF CONTRACT FOR SOLAR PHOTOVOLTAIC (PV) UTILITITY-INTERCONNED SYSTEMS FOR CIVIC CENTER FACILITIES.

RECOMMENDATION:

It is recommended that the City Council award the contract to Alpha Energy, a division of Alpha Technologies Services, Inc. located at 3767 Alpha Way, Bellingham, WA 98226 for the installation of four (4) utility-interconnected photovoltaic (PV) systems at the Loma Linda Civic Center facilities.

BACKGROUND:

Due to the recent concerns over energy demand and distribution in the State of California we are in an evaluation process with Southern California Edison to see how, as a city we can save energy and to what degree that would provides savings. A part of the energy saving plan was to evaluate the usefulness of photovoltaic (PV) power. Solar power is a growing industry and much advancement has been made in recent years. The evaluation clearly indicated that Loma Linda is in a prime geographic location and great environment to take advantage of a PV system. This interest and knowledge lead the City to apply for energy credits with the State of California through The Southern California Gas Company. We were required to submit our projects to see if they would qualify and if so, that the credits would remain available. We received confirmation that our projects were approved and we are conditionally awarded at least $780,150 in energy credits.

ANALYSIS:

We must decide if we are going authorize the project and therefore be able claim the energy credits. We have a deadline for project milestone on December 17, 2005 or the energy credits revert back.

AGENDA ITEM 8

Southern California has an Edison Energy Efficiency Program that we have joined. A part of the Energy Efficiency Program is designed to help the City reduce our demand and usage of energy through incentives and rebate programs. The programs allow us to utilize best practices that reduce our energy consumption. We are adopting these practices wherever feasible especially for the library expansion.

The photovoltaic (PV) system will allow us to reduce our energy consumption by approximately 75%. Although it is debatable that the costs of the systems with the energy credits included will ever pay for itself, the system will allow us to decrease our demand on Edison for energy. A long term perspective is necessary; therefore a 25 year schedule and limited warranty are attached in the proposal. The solar system is but one way for us to decrease our demand. We must continue to look for opportunities and programs that will allow us to be more energy efficient i.e. lowers our "carbon footprint". The PV system shows that we are willing to give our best effort to control our energy demands and ultimately costs.

The proposal outlines the project layout. Please note that it utilizes solar panels as covered parking.

ENVIROMENTAL:

CALIFORNIA ENVIRONMENTAL QUALITY ACT (CEQA) STATUS

The project is exempt from California Environmental Quality Act (CEQA) pursuant to the CEQA Guidelines Section 15303(e), which provides a Class 3 Categorical Exemption from CEQA for the construction of accessory structures including garages, carports, patios, swimming pools, and fences.

FINANCIAL IMPACT:

Funding will be provided from account no 77-1800-5800

Project Total	$2,112,668
Energy Credit	$780,150
Cost to City	$1,332,518

Attachments:

A) Alpha Proposal

Proposal

Loma Linda Civic Center
Utility-Interactive Photovoltaic Systems

Prepared by:
Rick Holz
Alpha Energy
A Division of Alpha Technologies Services, Inc.
3767 Alpha Way
Bellingham, WA 98226
(360) 392-2204

I. Executive Summary

Project Overview & Near-Term Objective

Alpha Energy proposes to install four (4) utility-interconnected photovoltaic (PV) systems on the Loma Linda Civic Center complex. These projects will be partially funded through Southern California Gas Company's Self-Generation Incentive Program (SGIP). The City of Loma Linda will provide the remainder of the funding.

The SGIP rebates have been reserved and in order to keep these funds on reserve, certain Project Advancement Milestones must be submitted to Southern California Gas Company beginning December 17, 2005. Included in these milestones are purchase orders for each of the proposed PV systems. Therefore, the goal of the upcoming city council meeting is to authorize the creation of these purchase orders so that the projects may proceed.

Technical Overivew

Utility-interactive PV systems are electrically very simple. The power source is an array of ***PV modules*** which convert sunlight directly into DC power. The DC power is converted to AC power with an ***inverter***. The AC power is fed directly onto the utility's power grid inside the building. The point where the PV system meets the utility grid is called the ***point of interconnection (POI)*** or the ***point of common coupling (PCC)***.

Every kilowatt-hour (kWh) of electricity produced by the PV systems will displace a kWh that would otherwise be purchased from the electric utility. Consequently, these systems will decrease the electric bills associated with the affected utility meters in the fire station, city hall, library, and senior center.

PV modules and inverters are just like any other electrical components that go into buildings these days. They are thoroughly tested to the standards set forth by the Underwriters Laboratories (UL), they are safe, and they work. Furthermore, it doesn't take very much effort to maintain these systems and to keep them operating well into the future.

For the Loma Linda projects, it is proposed that about half of the PV modules will be mounted on the roofs of the Civic Center buildings and the other half on carports which will be constructed in the south parking lot. The large majority of PV mounting racks which will go on the building roofs will not require penetrations into the roof. Instead these racks stay on the roof by virtue of ballasting provided by the PV modules, racking material, and concrete blocks around the perimeter of the rack. These professionally-engineered ballasted racks can be easily moved when roof maintenance is required. The carports are also professionally-engineered and are excellent for mounting PV modules.

Project Costing & Payback Period

The following table summarizes the cost and payback of each of the four proposed projects:

	Project A Fire Station	Project B City Hall	Project C Library	Project D Senior Center
Project Total Cost	$421,761	$1,103,909	$294,205	$292,793
Rebate Amount	$160,650	$408,800	$105,350	$105,350
Cost to City of Loma Linda	$261,111	$695,109	$188,855	$187,443
Payback Period (years)	21.3	23.0	22.1	22.1

II. Technical Description

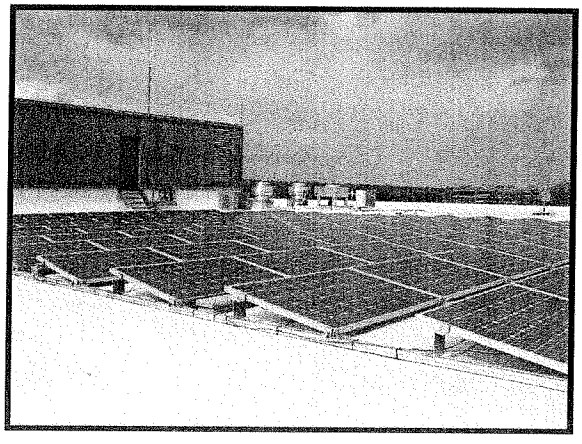
PV Sub-Array Layout

Figure 1 shows the overall layout of PV modules on the roofs of the Civic Center buildings and on the roofs of carports in the parking lot. The different colored areas on this figure indicate which modules are associated with the four different projects. The details of the sub-arrays are given in Table 1.

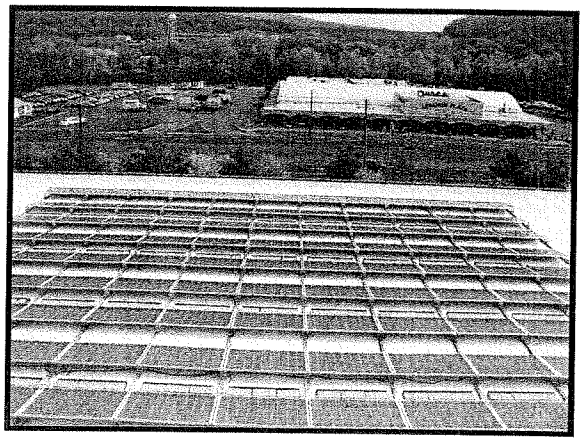
PV Module Mounts

Table 1 includes the mount type given by a letter designation A through D.

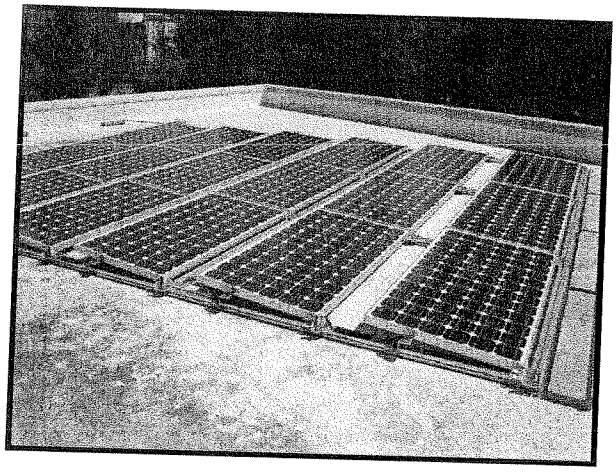
Mount Type A is a ballasted mount which simply lays on the roof and does not require attachment to the roof. There are pans around the perimeter of the sub-array in which concrete blocks are placed. This mount is used on building roof surfaces where the roof slope is less than 10 degrees. 44% of all PV modules will be mounted with Mount Type A. Below are various views of Mount Type A.



Mount Type A



Mount Type A

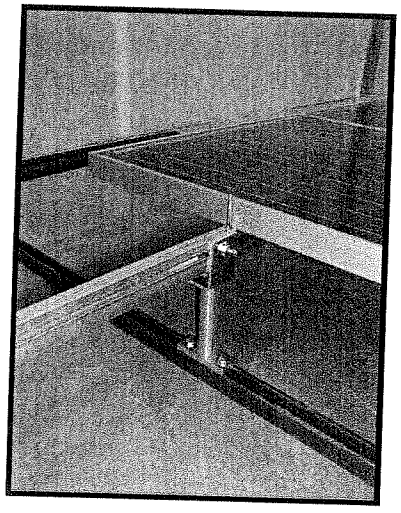


Mount Type A

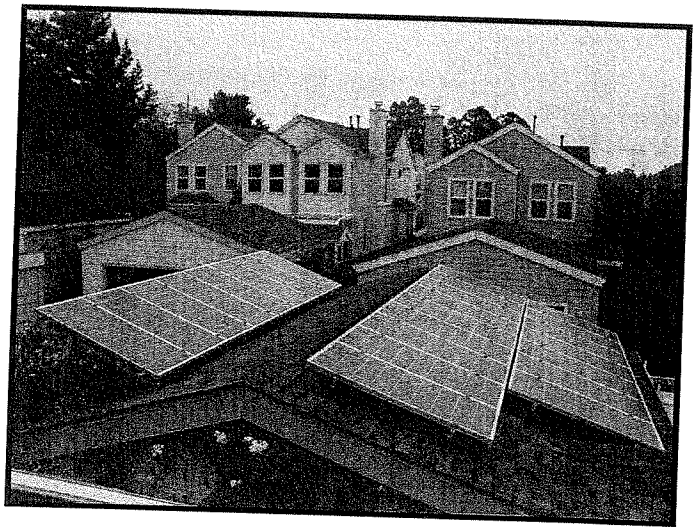
Mount Type B will be used on the roofs of the clerestories on the city hall building. It is an attached mount. The attachments will be stanchions which are bolted to the roof and flashed by a professional roofer. A cone flashing will most likely be used around the stanchion. There will be a total of 104 stanchions on three of the sub-arrays as follows:

Sub-Array	Qty - Stanchions
FS-7	40
CH-3	32
LIB-3	32

8% of all PV modules will be mounted with Mount Type B. Photos of this mount type are given below.

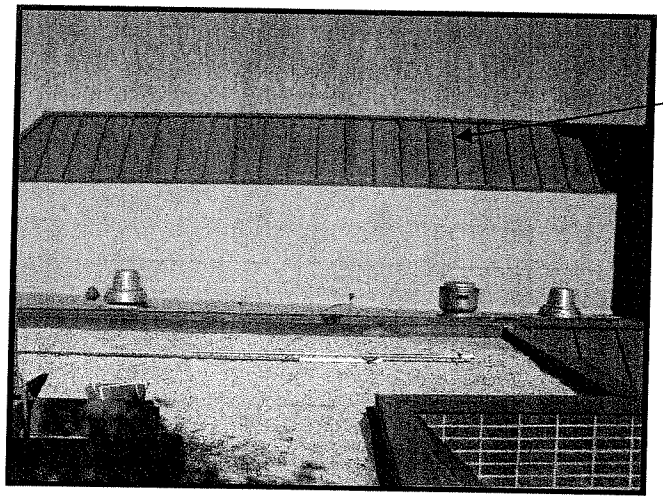


Mount Type B

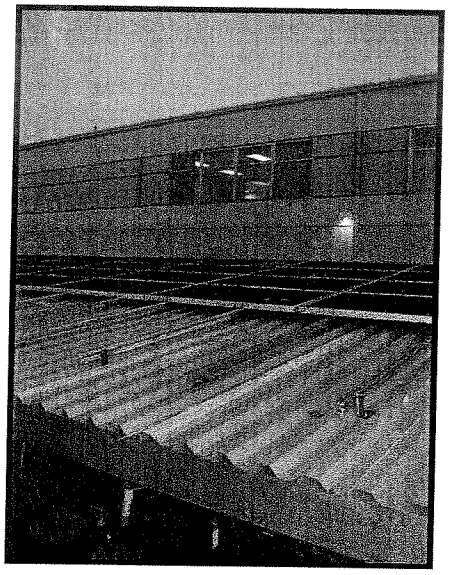


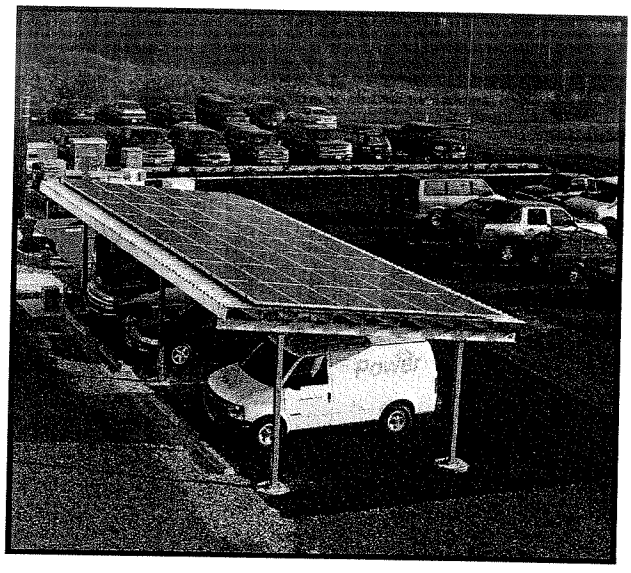
Mount Type B

Mount Type C will be used on one highly sloped roof surface on the fire station (see photo below). The PV module rails will be directly attached to the existing structure. Less than 1% of all PV modules will be attached this way.



Mount Type D will be used on all carports. It is an attached mount. 47% of all PV modules will be mounted on carports in this manner. Photos of this mount type are shown below.





Wiring Plan

The electrical one-lines for each project are given in Figures 2 through 5. The locations of the conduit/wire runs including the routing of underground wiring are shown in Figure 6. The underground wiring will require narrow trenches in the south parking lot. After the wiring is buried the parking lot will be restored to its original condition.

Each PV system is interconnected at the main service panel for each building – fire station, city hall, library, and senior center. Due to NEC® regulations, the main breaker or fuses in each service panel must be substituted with a new breaker or fuses of sizes given in the table below. There is sufficient oversizing in the main breakers (and fuses) that these substitutions can be made without disrupting service to any of the buildings. This was verified by an examination of the past five years' peak electrical loads.

Project	Inverter kW	PV Breaker Amps	Main Breaker Amps (w/o PV)	Main Breaker Amps (w/ PV)
Fire Station	50	175	400	225
City Hall	135	200	800	600
Library	30	100	400	300
Senior Center	30	100	400	300

PV System Equipment

The following table shows the primary PV system components. Specification sheets for the major components are provided under separate cover.

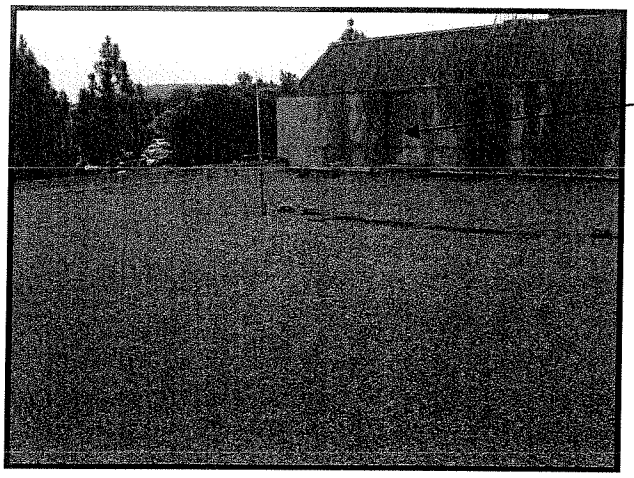
Component	Model	Manufacturer
PV Module	NE-170U1	Sharp
PV Mount A	Power Tube CRS	Direct Power & Water
PV Mount B - D	Power Rail	Direct Power & Water
String Combiner	Solaris Combiner	Alpha Technologies
DC Disconnect	H362RB	Square D
Power Conditioning Center	AE-30-60-PV-D AE-50-60-PV-D AE-135-60-PV-D	SatCon Power Systems

Locations of Power Conditioning Centers

The Power Conditioning Centers are locked cabinets packaged with the inverter, transformer, and all necessary switchgear. These are secure and can be placed outdoors or indoors. Figure 6 shows the proposed locations of the Power Conditioning Centers (labeled as "inverter location" on the figure).

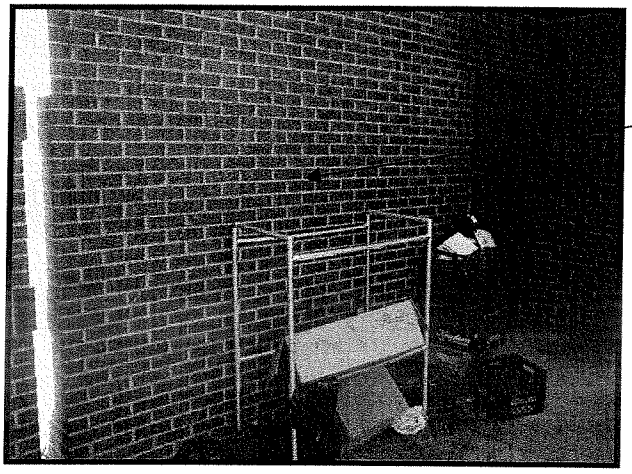
On the fire station, it is proposed that the power conditioning center be mounted on the north roof adjacent to the north-facing exterior wall which makes up the high north wall of the engine bay. The following photo shows this location.

On the city hall building it is proposed that the power conditioning center be placed in a new pen just to the north of the existing SCE transformer pen on the west side of the building.



Location of power conditioning equipment on fire station roof

On the library it is proposed that the power conditioning center be placed on the east exterior wall. This is a secure gated area. The following photo shows this location.



Location of power conditioning equipment on library

On the senior center it is proposed that the power conditioning center be placed in the storage room directly adjacent to the closet which houses the main service switchgear.

Carport Description & Parking Lot Impacts

The Flat Top design shown in Figure 7 is the general concept of the parking structure that will be used in these projects. The carports will be painted to match the existing aesthetic of the Loma Linda Civic Center.

Due to the planting of trees in the parking lot some shading will occur which will decrease the output of the PV modules during parts of the day. Removal or trimming of trees will improve performance of the affected PV modules. We highly recommend that the four pine trees along the south property line be removed. These trees will shade sub-array CH-7. These trees seem to provide little enhancement of the overall aesthetic.

III. Estimated Performance & Environmental Benefits

Figures 8 through 11 show the PV system performance estimates for each project. Included in these diagrams is the last years' kilowatt-hour consumption (these data were not available for the senior center however). The following table summarizes these data as well as gives the emission reduction of carbon dioxide due to the PV systems.

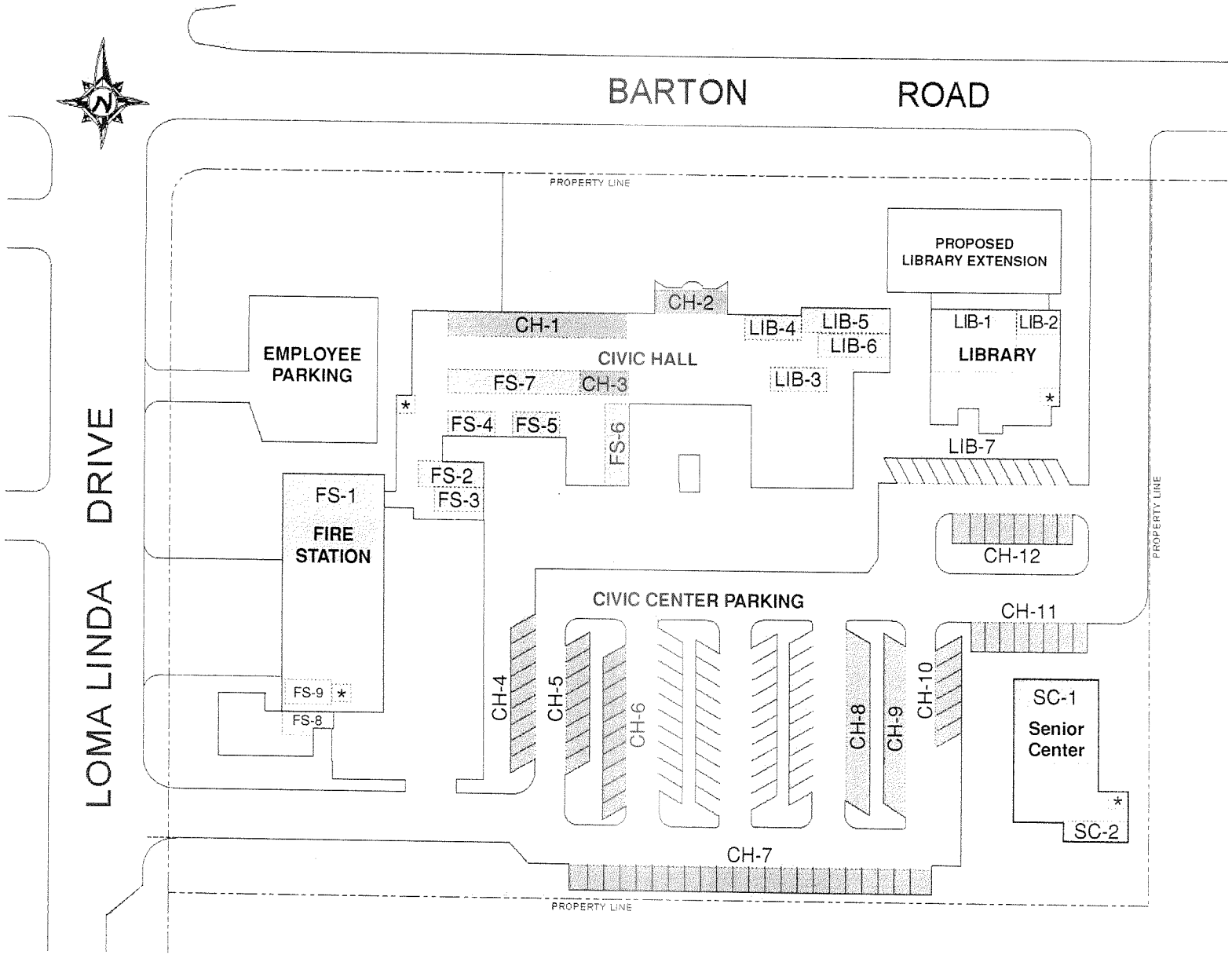
Project	Annual PV Generation (kWh)	Annual Electricity Use (kWh)	Percent of Bldg. Load Generated by PV	Annual CO2 Reduction (tons)
Fire Station	86,748	107,850	80%	
City Hall	190,901	407,520	47%	
Library	57,818	70,710	82%	
Senior Center	57,224	N/A	N/A	

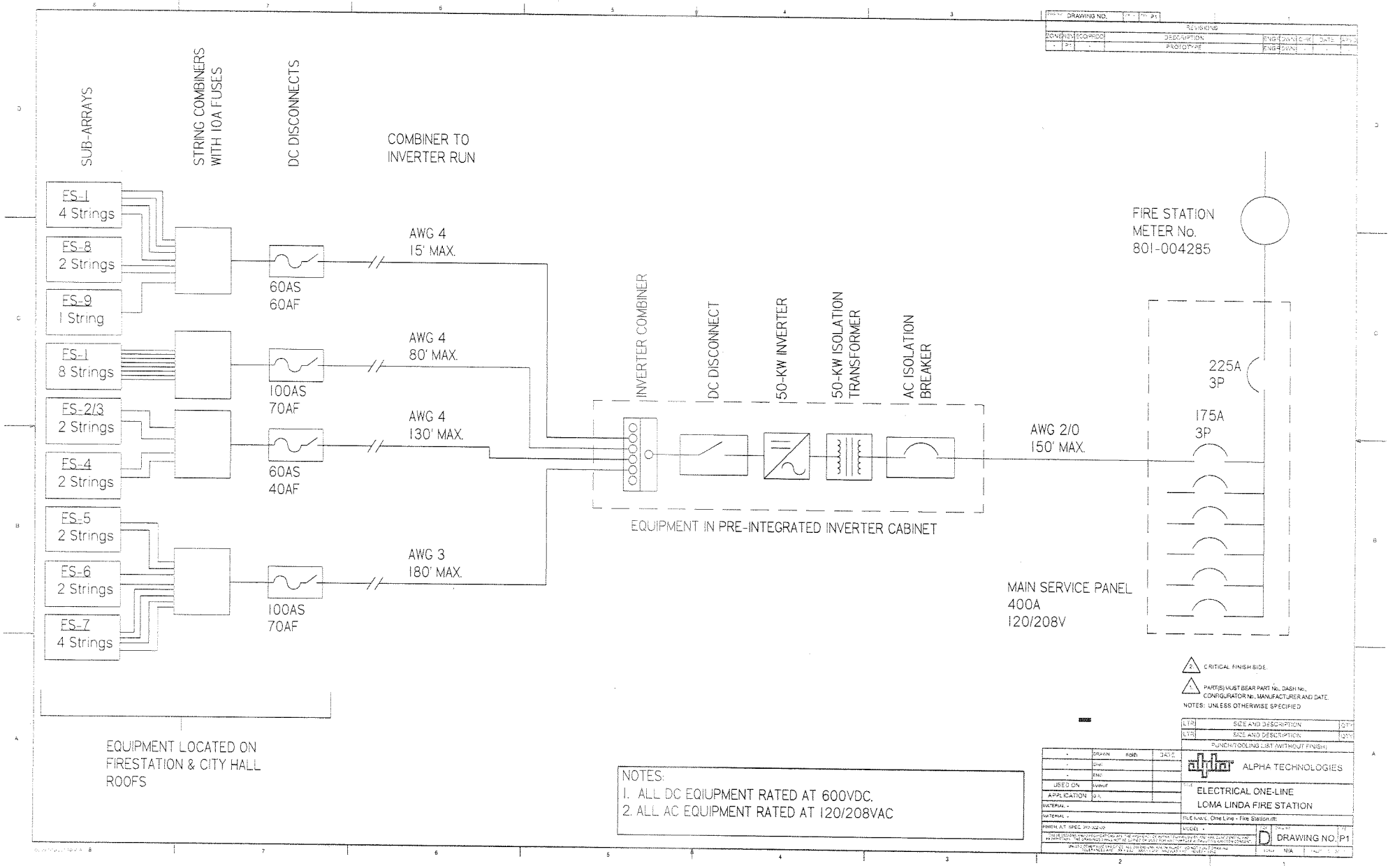
IV. Costing & Estimated Payback

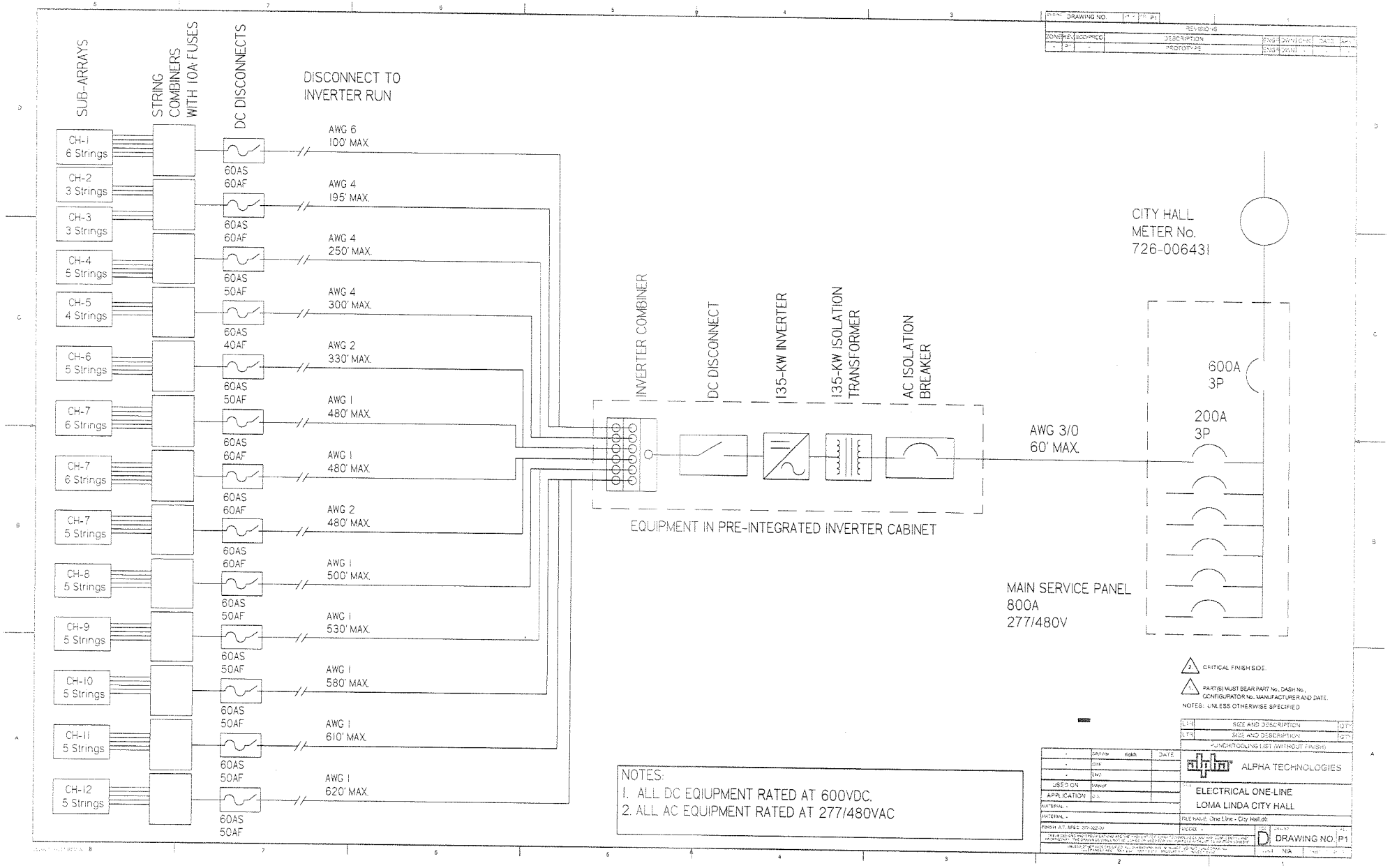
The following table summarizes the costs and paybacks to the customer for each project and for the total of all projects.

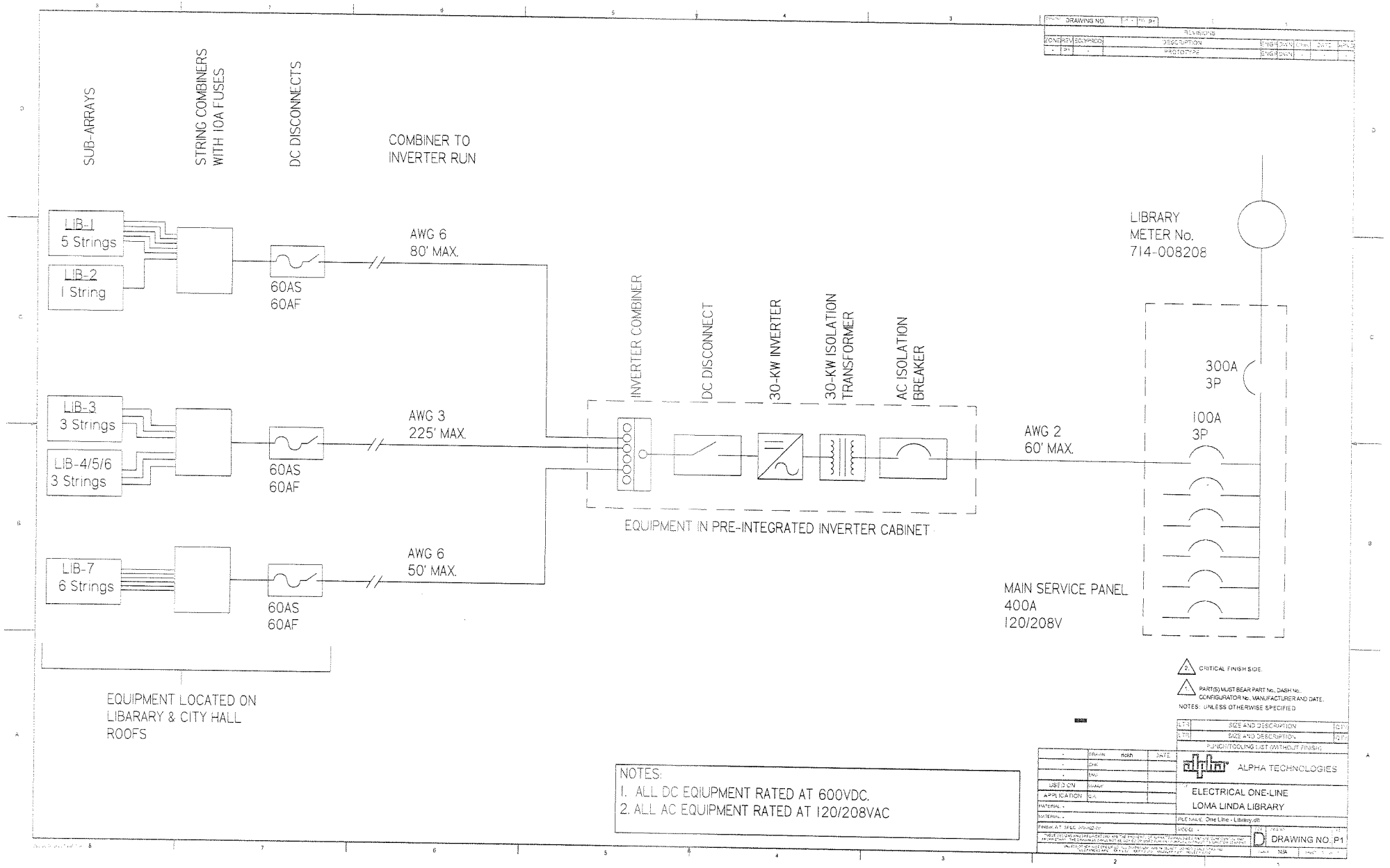
	Fire Station	City Hall	Library	Senior Center	Total
Turn-key Price	$421,761	$1,103,909	$294,205	$292,793	$2,112,668
Rebate Amount	$160,650	$408,800	$105,350	$105,350	$780,150
Cost to CLL	$261,111	$695,109	$188,855	$187,443	$1,332,518
kWh Production (25 years)	2,168,700	4,772,525	1,445,450	1,430,600	9,817,275
Cost per kWh	$0.120	$0.146	$0.131	$0.131	$0.136
Estimated Payback Period	21.3	23.0	22.1	22.1	22.4

Project	Annual PV Generation (kWh)	Annual Electricity Use (kWh)	Percent of Bldg. Load Generated by PV	Annual CO2 Reduction (tons)
Fire Station	86,748	107,850	80%	35
City Hall	190,901	407,520	47%	77
Library	57,818	70,710	82%	23
Senior Center	57,224	N/A	N/A	23


BARTON ROAD
LOMA LINDA DRIVE
PROPERTY LINE
PROPOSED LIBRARY EXTENSION
CH-2
CH-1
LIB-4
LIB-5
LIB-6
LIB-1
LIB-2
LIBRARY
EMPLOYEE PARKING
CIVIC HALL
FS-7
CH-3
LIB-3
FS-4
FS-5
FS-6
LIB-7
FS-2
FS-3
FS-1
FIRE STATION
CH-12
CIVIC CENTER PARKING
CH-11
CH-4
CH-5
CH-6
CH-8
CH-9
CH-10
SC-1
Senior Center
FS-9
FS-8
SC-2
CH-7
PROPERTY LINE
PROPERTY LINE


SUB-ARRAYS
STRING COMBINERS WITH 10A FUSES
DC DISCONNECTS
COMBINER TO INVERTER RUN
ES-1
4 Strings
ES-8
2 Strings
ES-9
1 String
ES-1
8 Strings
ES-2/3
2 Strings
ES-4
2 Strings
ES-5
2 Strings
ES-6
2 Strings
ES-7
4 Strings
60AS
60AF
100AS
70AF
60AS
40AF
100AS
70AF
AWG 4
15' MAX.
AWG 4
80' MAX.
AWG 4
130' MAX.
AWG 3
180' MAX.
INVERTER COMBINER
DC DISCONNECT
50-KW INVERTER
50-KW ISOLATION TRANSFORMER
AC ISOLATION BREAKER
EQUIPMENT IN PRE-INTEGRATED INVERTER CABINET
AWG 2/0
150' MAX.
FIRE STATION
METER No.
801-004285
225A
3P
175A
3P
MAIN SERVICE PANEL
400A
120/208V
EQUIPMENT LOCATED ON FIRESTATION & CITY HALL ROOFS
NOTES:
1. ALL DC EQIUPMENT RATED AT 600VDC.
2. ALL AC EQUIPMENT RATED AT 120/208VAC
CRITICAL FINISH SIDE.
PART(S) MUST BEAR PART No., DASH No., CONFIGURATOR No., MANUFACTURER AND DATE.
NOTES: UNLESS OTHERWISE SPECIFIED
PUNCH/TOOLING LIST (WITHOUT FINISH)
ALPHA TECHNOLOGIES
ELECTRICAL ONE-LINE
LOMA LINDA FIRE STATION
File Name: One Line - Fire Station.dft
DRAWING NO. P1


SUB-ARRAYS
STRING COMBINERS WITH 10A FUSES
DC DISCONNECTS
DISCONNECT TO INVERTER RUN
CH-1 6 Strings
CH-2 3 Strings
CH-3 3 Strings
CH-4 5 Strings
CH-5 4 Strings
CH-6 5 Strings
CH-7 6 Strings
CH-7 6 Strings
CH-7 5 Strings
CH-8 5 Strings
CH-9 5 Strings
CH-10 5 Strings
CH-11 5 Strings
CH-12 5 Strings
60AS 60AF
60AS 50AF
60AS 40AF
AWG 6 100' MAX.
AWG 4 195' MAX.
AWG 4 250' MAX.
AWG 4 300' MAX.
AWG 2 330' MAX.
AWG 1 480' MAX.
AWG 1 480' MAX.
AWG 2 480' MAX.
AWG 1 500' MAX.
AWG 1 530' MAX.
AWG 1 580' MAX.
AWG 1 610' MAX.
AWG 1 620' MAX.
INVERTER COMBINER
DC DISCONNECT
135-KW INVERTER
135-KW ISOLATION TRANSFORMER
AC ISOLATION BREAKER
EQUIPMENT IN PRE-INTEGRATED INVERTER CABINET
AWG 3/0 60' MAX.
CITY HALL METER No. 726-006431
600A 3P
200A 3P
MAIN SERVICE PANEL 800A 277/480V
NOTES:
1. ALL DC EQIUPMENT RATED AT 600VDC.
2. ALL AC EQUIPMENT RATED AT 277/480VAC
ALPHA TECHNOLOGIES
ELECTRICAL ONE-LINE
LOMA LINDA CITY HALL
DRAWING NO. P1



NOTES:
1. ALL DC EQIUPMENT RATED AT 600VDC.
2. ALL AC EQUIPMENT RATED AT 120/208VAC

2 CRITICAL FINISH SIDE.

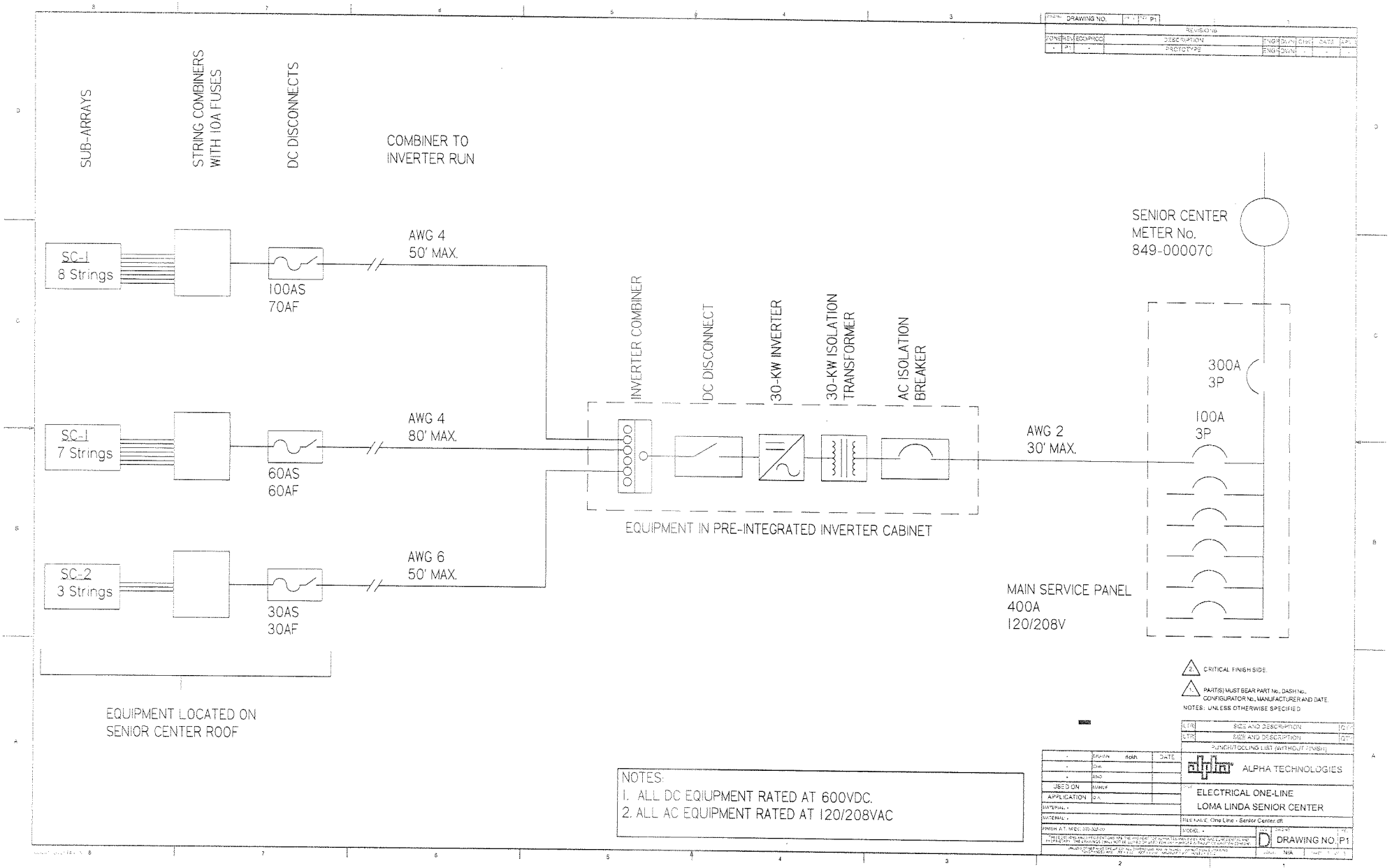
1 PART(S) MUST BEAR PART No., DASH No., CONFIGURATOR No., MANUFACTURER AND DATE.

NOTES: UNLESS OTHERWISE SPECIFIED

ALPHA TECHNOLOGIES

ELECTRICAL ONE-LINE
LOMA LINDA LIBRARY

DRAWING NO. P1



NOTES:
1. ALL DC EQIUPMENT RATED AT 600VDC.
2. ALL AC EQUIPMENT RATED AT 120/208VAC

2. CRITICAL FINISH SIDE.

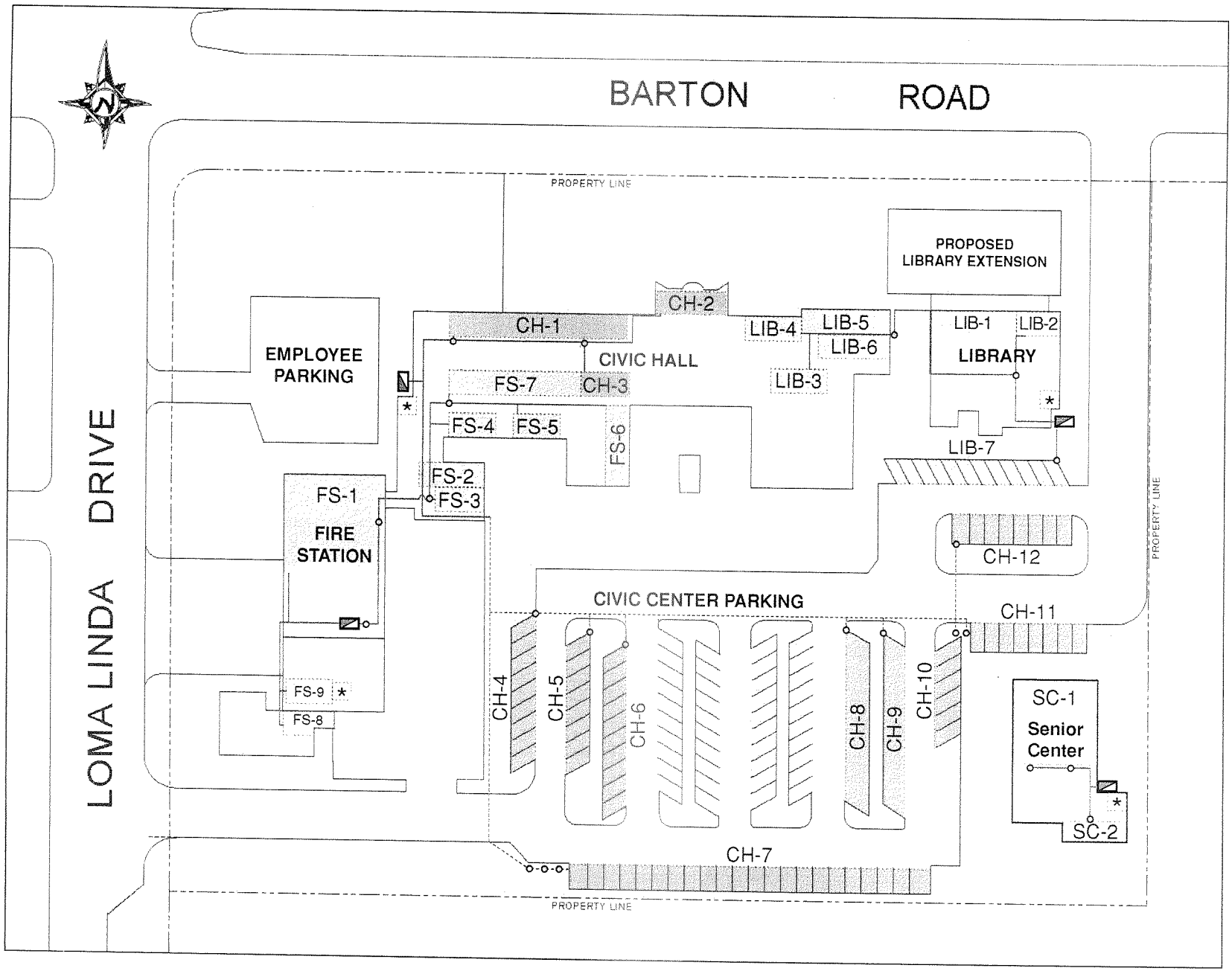
1. PART(S) MUST BEAR PART No., DASH No., CONFIGURATOR No., MANUFACTURER AND DATE.

NOTES: UNLESS OTHERWISE SPECIFIED

ALPHA TECHNOLOGIES

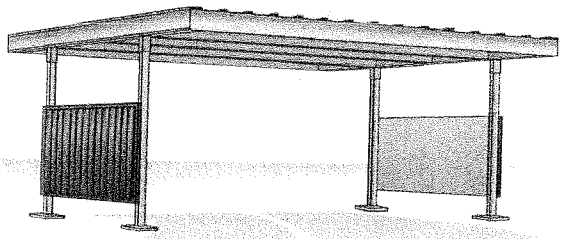
ELECTRICAL ONE-LINE
LOMA LINDA SENIOR CENTER

DRAWING NO. P1

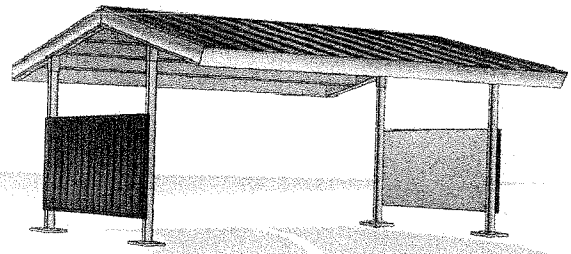

BARTON ROAD
LOMA LINDA DRIVE
PROPERTY LINE
PROPOSED LIBRARY EXTENSION
EMPLOYEE PARKING
CH-1
CH-2
CIVIC HALL
LIB-4
LIB-5
LIB-6
LIB-1
LIB-2
LIBRARY
LIB-3
FS-7
CH-3
FS-4
FS-5
FS-6
LIB-7
FS-2
FS-3
FS-1
FIRE STATION
CH-12
CIVIC CENTER PARKING
CH-11
CH-4
CH-5
CH-6
CH-8
CH-9
CH-10
SC-1
Senior Center
FS-9
FS-8
SC-2
CH-7
PROPERTY LINE
Roof Wiring
Underground Wiring
Point of Interconnection
Inverter Location
Combiner Location

Carport Structures Corp.
Covered Parking Solutions for Any Application
1825 Metamora Road, Oxford, MI 48371 Ph 248-628-5571 Fax 248-628-5260

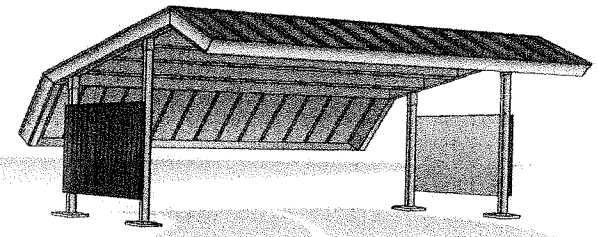
Standard roof designs



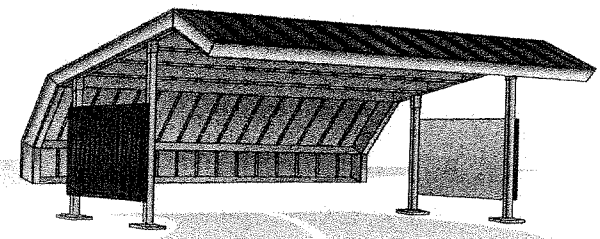
Flat Top



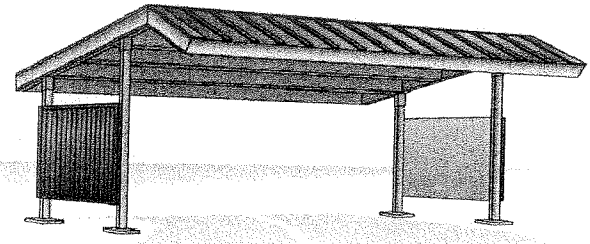
Even Gable



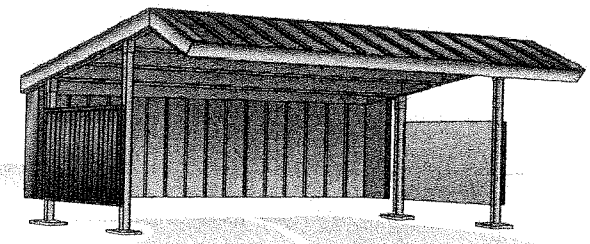
Double Mansard



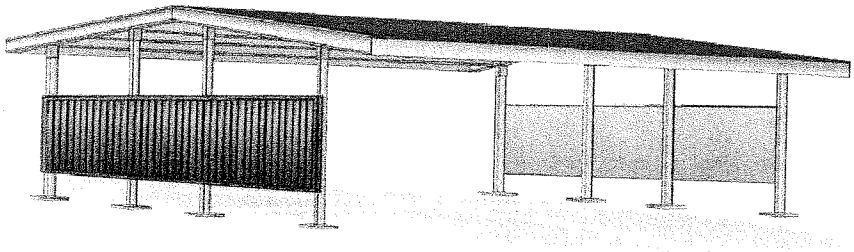
Double Mansard with tail



Single Mansard



Single Mansard straight back



Double Flat Top / Gable

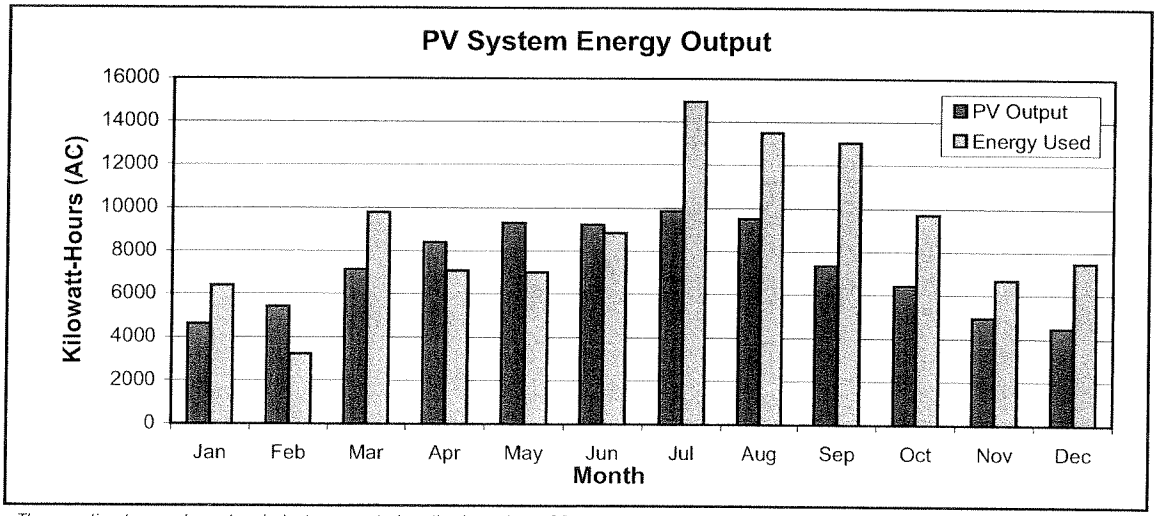
PV System Energy Output Estimate

System Type: SunSystem Name: Loma Linda Fire Station

City		Array 1	Array 2	Array 3	
CA-Los Angeles	Roof pitch angle	5	14	50	*(degrees from horizontal)*
	Roof orientation angle	166	166	166	*(magnetic bearing)*
Latitude	Panel tilt-up angle	0	0	0	*(Right angle to roof pitch)*
34	Array rated size	44.88	8.16	2.04	*(kW DC)*
Declination	Array elevation angle	5	14	50	*(degrees from horizontal)*
14	Array orientation	0	0	0	*(degrees from true south)*

Results:

Month	Array 1 sun-hr/ day	Array 2 sun-hr/ day	Array 3 sun-hr/ day	Array 1 kWh/mo	Array 2 kWh/mo	Array 3 kWh/mo	All Arrays kWh/mo	Energy used kWh/mo
Jan	3.1	3.6	4.6	3631	755	242	4628	6420
Feb	4.1	4.6	5.5	4299	871	259	5430	3240
Mar	5.0	5.3	5.5	5744	1110	288	7142	9780
Apr	6.1	6.3	5.7	6836	1275	288	8398	7110
May	6.6	6.6	5.3	7636	1386	281	9303	7020
Jun	6.8	6.7	5.2	7596	1366	265	9227	8850
Jul	7.0	7.0	5.5	8118	1464	286	9868	14940
Aug	6.7	6.8	5.9	7767	1433	309	9509	13500
Sep	5.3	5.6	5.5	5948	1133	279	7361	13050
Oct	4.4	4.9	5.5	5133	1021	289	6443	9720
Nov	3.5	4.0	5.0	3904	804	252	4960	6720
Dec	3.0	3.5	4.7	3493	739	247	4479	7500
Avg. monthly	**5.2**	**5.4**	**5.3**	**5842**	**1113**	**274**	**7229**	**8988**
Total annual				**70104**	**13358**	**3285**	**86,747**	**107,850**
						PV to generate		**80%**



These estimates are based on industry accepted methods and use 30-year average weather data. Your actual PV system output may vary.

This PV system should provide about 80% of your electricity in a year with average weather.

PV System Energy Output Estimate

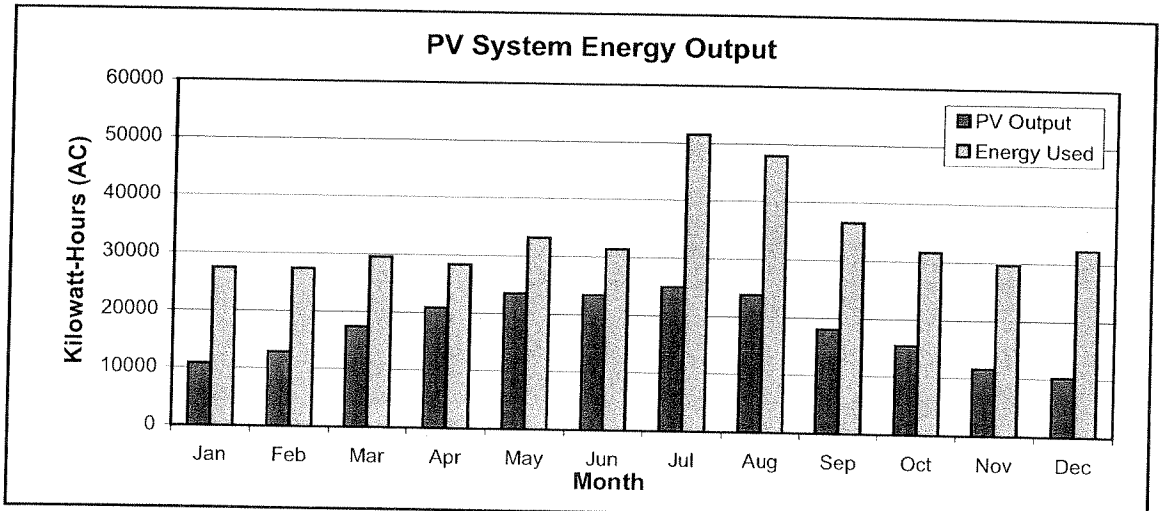
System Type: SunSystem Name: Loma Linda City Hall

City: CA-Los Angeles
Latitude: 34
Declination: 14

	Array 1	Array 2	Array 3	
Roof pitch angle	5	5	5	*(degrees from horizontal)*
Roof orientation angle	166	76	256	*(magnetic bearing)*
Panel tilt-up angle	0	0	0	*(Right angle to roof pitch)*
Array rated size	79.56	30.6	28.56	*(kW DC)*
Array elevation angle	5	5	5	*(degrees from horizontal)*
Array orientation	0	-90	90	*(degrees from true south)*

Results:

Month	Array 1 sun-hr/ day	Array 2 sun-hr/ day	Array 3 sun-hr/ day	Array 1 kWh/mo	Array 2 kWh/mo	Array 3 kWh/mo	All Arrays kWh/mo	Energy used kWh/mo
Jan	3.1	2.9	2.9	6437	2251	2101	10789	27420
Feb	4.1	3.8	3.9	7622	2680	2560	12862	27420
Mar	5.0	4.7	4.8	10182	3722	3498	17403	29580
Apr	6.1	5.9	6.0	12118	4522	4255	20895	28440
May	6.6	6.5	6.6	13537	5117	4844	23498	33240
Jun	6.8	6.7	6.8	13465	5092	4865	23421	31440
Jul	7.0	6.9	7.0	14390	5467	5158	25015	51540
Aug	6.7	6.6	6.6	13769	5194	4843	23806	48000
Sep	5.3	5.1	5.1	10545	3896	3649	18089	36660
Oct	4.4	4.2	4.1	9099	3296	3039	15434	31740
Nov	3.5	3.2	3.2	6920	2454	2255	11629	29700
Dec	3.0	2.7	2.7	6192	2153	1980	10325	32340
Avg. monthly	**5.2**	**4.9**	**5.0**	**10356**	**3820**	**3587**	**17764**	**33960**
Total annual				**124275**	**45843**	**43047**	**213,165**	**407,520**
						PV to generate		**52%**



These estimates are based on industry accepted methods and use 30-year average weather data. Your actual PV system output may vary.

This PV system should provide about 52% of your electricity in a year with average weather.

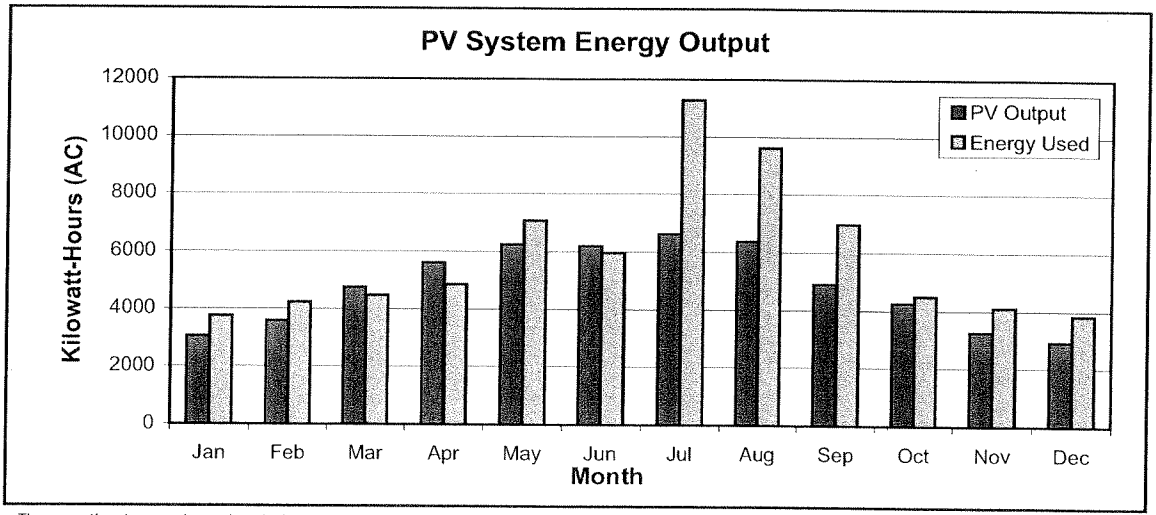
PV System Energy Output Estimate

System Type: SunSystem Name: Loma Linda Library

City		Array 1	Array 2	Array 3	
CA-Los Angeles	Roof pitch angle	5	14	0	*(degrees from horizontal)*
	Roof orientation angle	166	166	0	*(magnetic bearing)*
Latitude	Panel tilt-up angle	0	0	0	*(Right angle to roof pitch)*
34	Array rated size	30.6	6.12	0	*(kW DC)*
Declination	Array elevation angle	5	14	0	*(degrees from horizontal)*
14	Array orientation	0	0	-166	*(degrees from true south)*

Results:

Month	Array 1 sun-hr/ day	Array 2 sun-hr/ day	Array 3 sun-hr/ day	Array 1 kWh/mo	Array 2 kWh/mo	Array 3 kWh/mo	All Arrays kWh/mo	Energy used kWh/mo
Jan	3.1	3.6	2.9	2476	566	0	3042	3750
Feb	4.1	4.6	3.8	2931	653	0	3585	4230
Mar	5.0	5.3	4.8	3916	833	0	4749	4470
Apr	6.1	6.3	6.0	4661	956	0	5617	4860
May	6.6	6.6	6.6	5206	1039	0	6246	7080
Jun	6.8	6.7	6.8	5179	1025	0	6204	5970
Jul	7.0	7.0	7.0	5535	1098	0	6633	11280
Aug	6.7	6.8	6.6	5296	1075	0	6370	9630
Sep	5.3	5.6	5.1	4056	850	0	4906	6990
Oct	4.4	4.9	4.2	3499	766	0	4265	4500
Nov	3.5	4.0	3.2	2662	603	0	3265	4110
Dec	3.0	3.5	2.7	2382	555	0	2936	3840
Avg. monthly	**5.2**	**5.4**	**5.0**	**3983**	**835**	**0**	**4818**	**5893**
Total annual				**47798**	**10019**	**0**	**57,817**	**70,710**
							PV to generate	**82%**



These estimates are based on industry accepted methods and use 30-year average weather data. Your actual PV system output may vary.

This PV system should provide about 82% of your electricity in a year with average weather.

PV System Energy Output Estimate

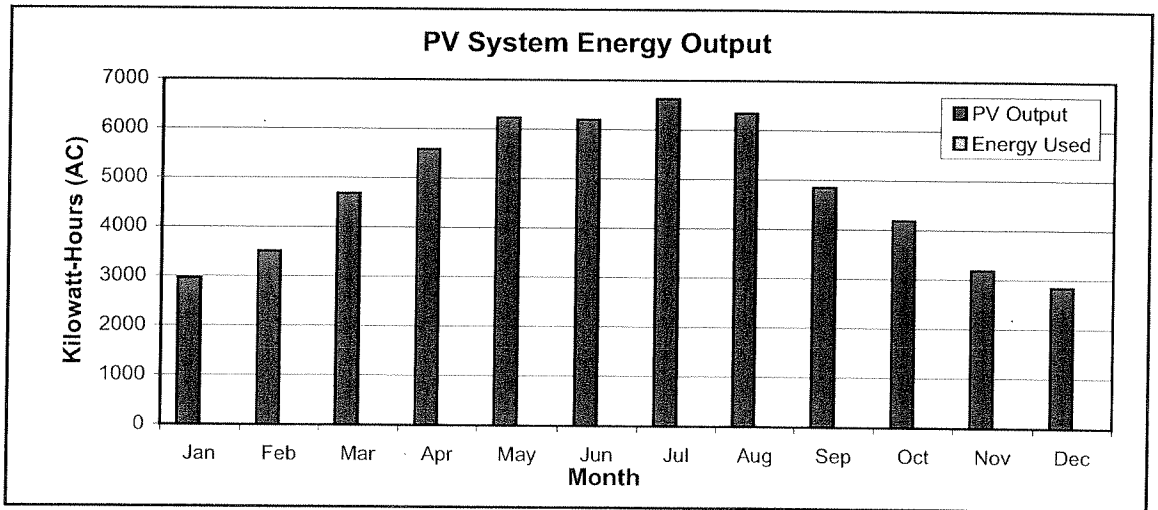
System Type: SunSystem Name: Loma Linda Senior Center

		Array 1	Array 2	Array 3	
City	Roof pitch angle	5	5	5	*(degrees from horizontal)*
CA-Los Angeles	Roof orientation angle	76	256	166	*(magnetic bearing)*
Latitude	Panel tilt-up angle	5	5	0	*(Right angle to roof pitch)*
34	Array rated size	15.3	15.3	6.12	*(kW DC)*
Declination	Array elevation angle	7	7	5	*(degrees from horizontal)*
14	Array orientation	-45	45	0	*(degrees from true south)*

Results:

Month	Array 1 sun-hr/ day	Array 2 sun-hr/ day	Array 3 sun-hr/ day	Array 1 kWh/mo	Array 2 kWh/mo	Array 3 kWh/mo	All Arrays kWh/mo	Energy used kWh/mo
Jan	3.1	3.1	3.1	1235	1235	495	2965	0
Feb	4.1	4.2	4.1	1446	1477	586	3510	0
Mar	4.9	5.0	5.0	1946	1959	783	4689	0
Apr	6.1	6.1	6.1	2314	2333	932	5579	0
May	6.5	6.6	6.6	2577	2614	1041	6233	0
Jun	6.7	6.9	6.8	2552	2612	1036	6200	0
Jul	7.0	7.0	7.0	2744	2774	1107	6625	0
Aug	6.7	6.7	6.7	2641	2639	1059	6339	0
Sep	5.3	5.3	5.3	2019	2026	811	4855	0
Oct	4.5	4.4	4.4	1755	1735	700	4190	0
Nov	3.5	3.5	3.5	1337	1318	532	3187	0
Dec	3.0	3.0	3.0	1195	1180	476	2852	0
Avg. monthly	**5.1**	**5.2**	**5.2**	**1980**	**1992**	**797**	**4768**	**0**
Total annual				**23761**	**23901**	**9560**	**57,222**	**0**

PV to generate



These estimates are based on industry accepted methods and use 30-year average weather data. Your actual PV system output may vary.

This PV system should provide about % of your electricity in a year with average weather.

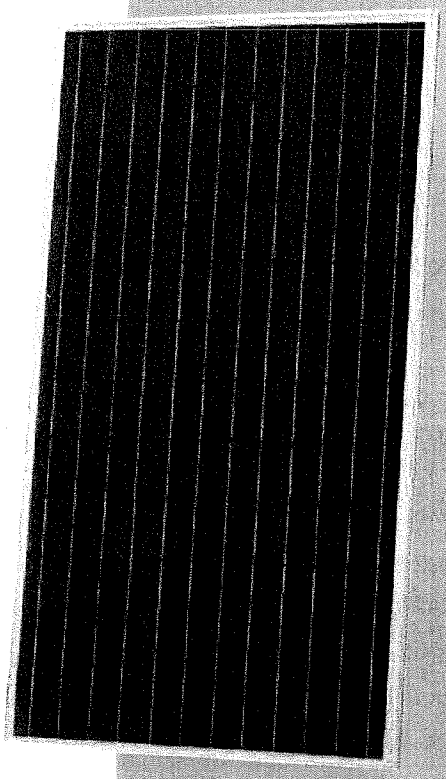
SHARP

MULTI-PURPOSE MODULE

NE-170U1

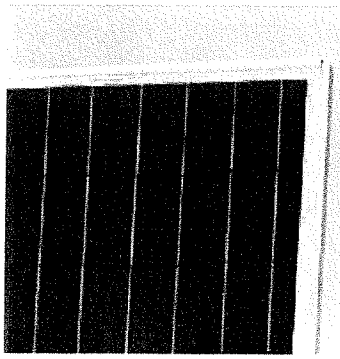
170 WATT

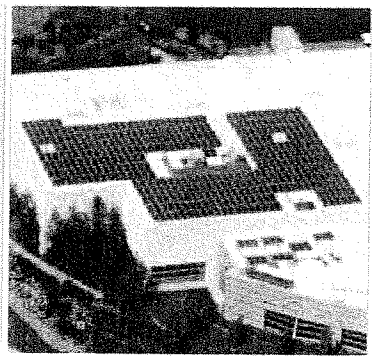
HIGH-POWERED MODULE. SUPERIOR PERFORMANCE.



POLY-CRYSTALLINE SILICON PHOTOVOLTAIC MODULE WITH 170W MAXIMUM POWER

Sharp's NE-170U1 photovoltaic modules offer high-powered performance and industry-leading durability for large electrical power requirements. Using breakthrough technology perfected by Sharp's 45 years of research and development, these modules incorporate an advanced surface texturing process to increase light absorption and improve efficiency. Common applications include office buildings, houses, cabins, solar power stations, solar villages and traffic lights. Ideal for grid-connected systems and designed to withstand rigorous operating conditions, Sharp's NE-170U1 modules are the perfect combination of technology and reliability.





FEATURES

- High-power module (170W) using 125mm square poly-crystalline silicon solar cells with 13.10% module conversion efficiency
- Sharp's advanced surface texturing process increases light absorption and efficiency while providing a more subdued, "natural" look
- Bypass diodes minimize the power drop caused by shade
- Water white, tempered glass, EVA laminate, plus aluminum frame for extended outdoor use
- Nominal 24VDC output is perfect for grid-connected systems
- UL Listings: UL1703, cUL
- Sharp modules are manufactured in ISO 9001 certified facilities
- 25 year limited warranty on power output

MULTI-PURPOSE MODULE

ELECTRICAL CHARACTERISTICS

Cell	Poly-crystalline silicon
No. of Cells and Connections	72 in series
Open Circuit Voltage (Voc)	43.2V
Maximum Power Voltage (Vpm)	34.8V
Short Circuit Current (Isc)	5.47A
Maximum Power Current (Ipm)	4.9A
Maximum Power (Pmax)*	170W (+10% / -5%)
Module Efficiency (ηm)	13.10%
Maximum System Voltage	600VDC
Series Fuse Rating	10A
Type of Output Terminal	Lead Wire with MC Connector

* (STC) Standard Test Conditions: 25°C, 1 kW/m², AM 1.5

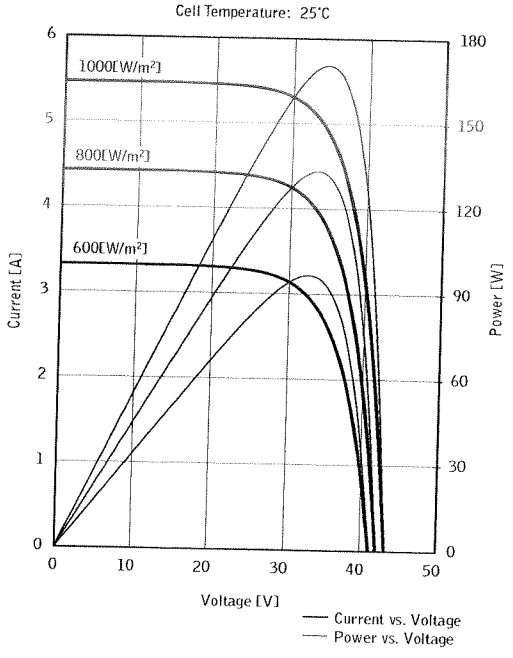
MECHANICAL CHARACTERISTICS

Dimensions (A x B x C below)	62.01" x 32.52" x 1.81" 1575mm x 826mm x 46mm
Weight	37.485lbs / 17.0kg
Packing Configuration	2 pcs per carton
Size of Carton	66.93" x 38.19" x 5.12" 1700mm x 970mm x 130mm
Loading Capacity (20 ft container)	168 pcs (84 cartons)
Loading Capacity (48 ft container)	448 pcs (224 cartons)
Loading Capacity (53 ft container)	504 pcs (252 cartons)

ABSOLUTE MAXIMUM RATINGS

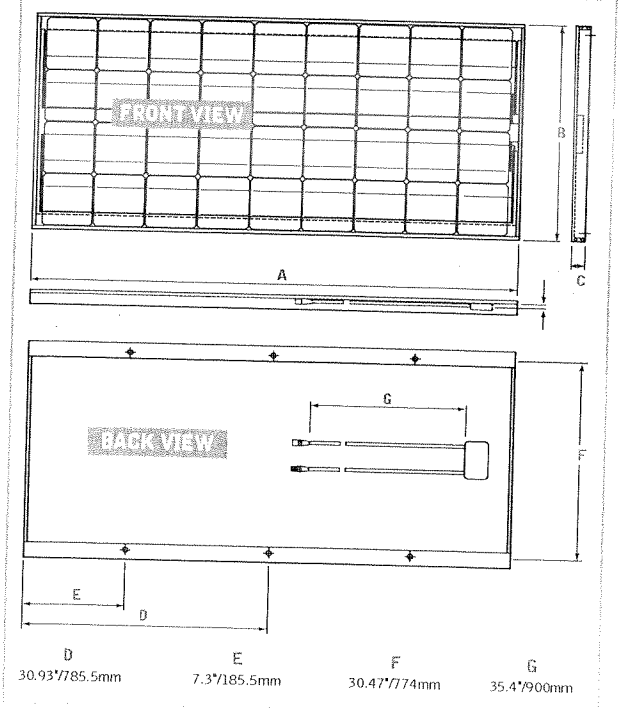
Operating Temperature	-40 to +194°F / -40 to +90°C
Storage Temperature	-40 to +194°F / -40 to +90°C

I-V CURVES



Current, Power vs. Voltage Characteristics

DIMENSIONS



D	E	F	G
30.93"/785.5mm	7.3"/185.5mm	30.47"/774mm	35.4"/900mm

Design and specifications are subject to change without notice.

In the absence of confirmation by product manuals, Sharp takes no responsibility for any defects that may occur in equipment using any Sharp devices. Contact Sharp to obtain the latest product manuals before using any Sharp device.

c UL us

SHARP

Sharp Electronics Corporation · 5901 Bolsa Avenue, Huntington Beach, CA 92647
Tel:1-800-SOLAR-06 · E-mail: sharpsolar@sharpusa.com · www.sharpusa.com/solar

Cover photo: Solar installation by Pacific Power Management, Auburn CA

SSD-170-805

Printed in the USA

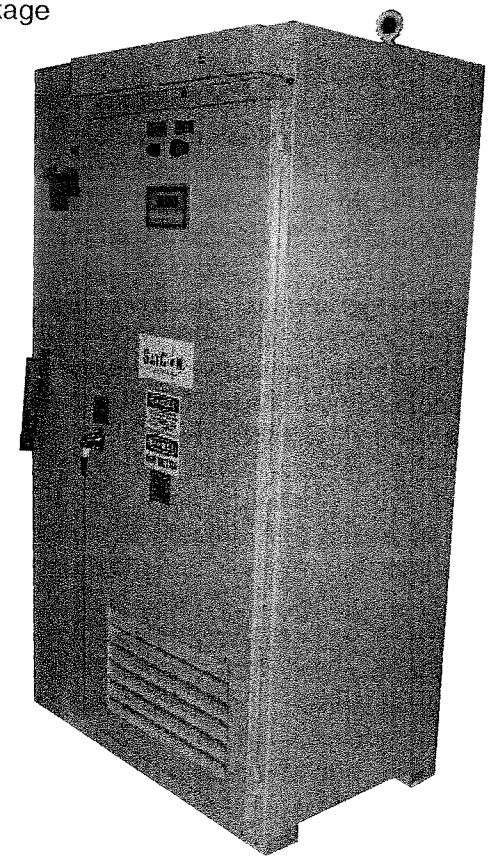
SATCON
Power Systems

POWERGATE™ Photovoltaic 30kW Power Converter System

SatCon's **PowerGate™** power converter for photovoltaic applications (AE-PV Series), available in 120/240 Volt single phase, 208, 240, and 480 Volt three phase versions is a 30 kW grid-tie interactive inverter designed to convert power generated by PV arrays into utility grade power for export to the utility grid. The **PowerGate™** Model AE-30-60-PV has the highest weighted efficiency listed for approved CEC inverters in its power rating.

PowerGate™AE-PV Series Features

- Fully integrated system, Complete electrical conversion installation in one box
- Intelligent wake up and sleep algorithms at dusk and dawn squeeze out maximum kWhr exported
- Use of film capacitors increases life up to four times over electrolytic capacitors used by others
- Low sleep mode power consumption increases net energy delivered to the grid
- Field wiring compartments reduce installation time and cost. No field interconnect between components
- Filtered top air entry/bottom exhaust reduces debris blockage
- Soft charge network limits AC inrush on system wake up
- Highest overall efficiency available on the market today
- Wider input Voltage range
- Highly accurate peak power tracking, increases overall energy produced
- Smaller overall system footprint
- DC Contactor quickly isolates any faults that may occur on PV cabling.
- AC Line contactor isolates high efficiency transformer from the grid in sleep mode
- Full system monitoring and metering via front panel display and RS232/485 communication port.
- Approved Built-In Metering accuracy better than ± 1%
- Discharge contactor removes stored energy on DC bus for customer safety
- Sloped roof prevents standing water
- Top, bottom and side cable entries



System Includes:

- High efficiency isolation transformer
- Input fused disconnect & contactor
- AC line breaker & contactor
- Generating Power indicator
- Keypad with alpha-numeric four-line display
- Top lifting eye-bolts
- AC & DC surge protection

SatCon's power converter software has been UL1741 certified for a number of grid-connect alternative energy applications. The AE-PV **PowerGate™** series power converter is designed to meet the requirements of IEEE1547, UL 1741 for CEC listing. This ensures safe, reliable grid connection with **PowerGate's™** certified controls for anti-island detection.

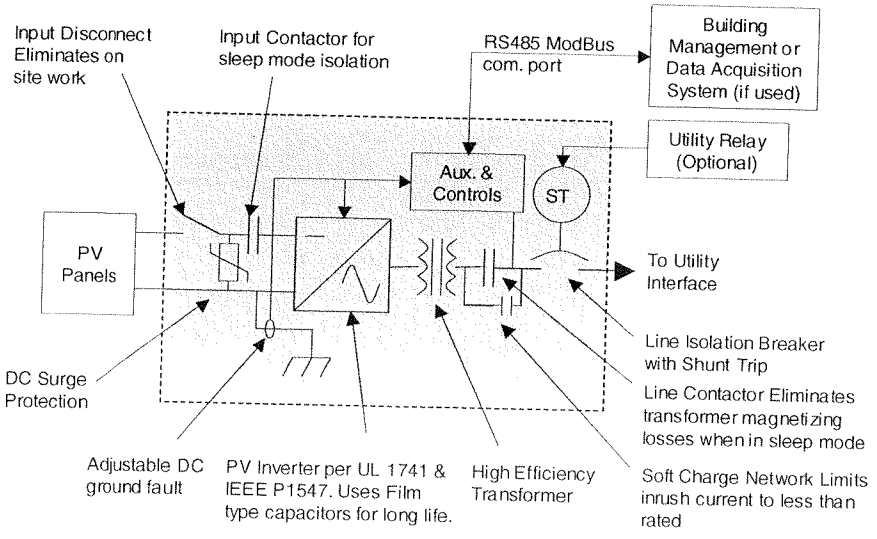
SATCON Power Systems

POWERGATE™ Photovoltaic 30kW Power Converter System

Model AE-30-60-PV Specifications:

Rated output:	30 kW			
AC Voltage Range:	+/-10% Vnom., 60Hz			
Model Voltage Suffix	A	F	D	E
AC Rated Voltages:	480V	240V	208V	120/240V
Phases:	3	3	3	1
AC Rated Currents:	36A	72A	83A	125A
AC Power Factor:	0.99pf Lag			
Nominal DC:	400 Volts, 96A rms max with programmable current limit, 114Apk.			
Min DC input for Rated kW:	330 Vdc @ nom. line			
Power Tracking Window:	280 to 660 VDC			
Current Harmonics:	<3% TDD			
Min Power for Wake/Sleep:	400W			
Peak Inverter Efficiency:	96.7%			
Peak System Efficiency:	92.8%			
Weighted System Efficiency:	93% as per CEC			
Max. Heat Dissipation	2.2kW at 30kW delivery			
Enclosure type:	NEMA 1 and NEMA 3R, Seismic Zone 4, 11 gauge steel			
Dimensions: (h x w x d)	1780 x 1020 x 610 mm (70 x 40 x 24in)			
Weight:	1700lbs, 770kg			
Humidity: (relative)	95% (non-condensing)			
Ambient Temp:	-20 to +50°C (-4 to 122°F) @ 6000ft.			
Storage Temp:	-40 to 85°C (-40 to 185°F)			
Array Configuration:	Monopole grounded (See Other Options)			
AC Line Terminals	M8 (5/16") studded h/w on 1" Bus			
DC Terminals	M8 (5/16") x 2 studded h/w per pole			
UL1741 certified & CEC listing	Model AE-30-60-PV-E			

PowerGate™ Power Conversion System



Standard Features
Maximum peak power tracking
Overload on temperature permit
DC & AC voltage surge protection
Adjustable DC ground fault
Event log in non volatile memory
NC contact for AC line breaker trip
Automatic:
Wake up / sleep sequencing
Grid synchronization
Reconnect on grid restoration
Local & Remote Monitoring:
Grid status
DC input power
DC input voltage
DC input current
Line kVAR
Line kW
Line kVA
Line kWHr.
Power Factor
Three Line to Neutral Voltages
Three Line + Neutral Currents
Protection & Diagnostics:
Emergency stop
Control & power supply fault
Inverter over current
Input Over Voltage
Door open
Fan fault
Blown Fuse
Contactor Fault
Magnetics Over Temperature
Inverter Over Temperature
Line over/under voltage & frequency
Line & Neutral over current
Gating fault
Options:
3 p fused combiner. (-ve gnd.)
Various external combiners
2 pole DC disc. (Floating or center grounding available)
50 Hz & various line voltages
Condensation limiting heater
Higher Breaker interrupt ratings
CE certification
Consult factory for other options

SatCon Power Systems, A division of SatCon Technologies Phone 905-639-4692 Fax 905-639-0961 Email: powersystems.sales@satcon.com

SATCON
Power Systems

POWERGATE™ Photovoltaic 50kW Power Converter System

SatCon's **PowerGate™** power converter for photovoltaic applications (AE-PV Series), available in 120/240 Volt single phase, 208, 240, and 480 Volt three phase versions is a 50 kW grid-tie interactive inverter designed to convert power generated by PV arrays into utility grade power for export to the utility grid. The **PowerGate™** Model AE-50-60-PV-A has the highest weighted efficiency listed for approved CEC inverters in its power range.

PowerGate™AE-PV Series Features

- Fully integrated system, Complete electrical conversion installation in one box
- Intelligent wake up and sleep algorithms at dusk and dawn squeeze out maximum kWhr exported
- Use of film capacitors increases life up to four times over electrolytic capacitors used by others
- Low sleep mode power consumption increases net energy delivered to the grid
- Field wiring compartments reduce installation time and cost. No field interconnect between components
- Filtered top air entry/bottom exhaust reduces debris blockage
- Soft charge network limits AC inrush on system wake up
- Highest overall efficiency available on the market today
- Wider input Voltage range
- Highly accurate peak power tracking, increases overall energy produced
- Smaller overall system footprint
- DC Contactor quickly isolates any faults that may occur on PV cabling.
- AC Line contactor isolates high efficiency transformer from the grid in sleep mode
- Full system monitoring and metering via front panel display and RS232/485 communication port.
- Approved Built-In Metering accuracy better than ± 1%
- Discharge contactor removes stored energy on DC bus for customer safety
- Sloped roof prevents standing water
- Top, bottom and side cable entries

System Includes:

- High efficiency isolation transformer
- Input fused disconnect & contactor
- AC line breaker & contactor
- Generating Power indicator
- Keypad with alpha-numeric four-line display
- Top lifting eye-bolts
- AC & DC surge protection

SatCon's power converter software has been UL1741 certified for a number of grid-connect alternative energy applications. The AE-PV **PowerGate™** series power converter is designed to meet the requirements of IEEE1547, UL 1741 for CEC listing. This ensures safe, reliable grid connection with **PowerGate**'s™ certified controls for anti-island detection.

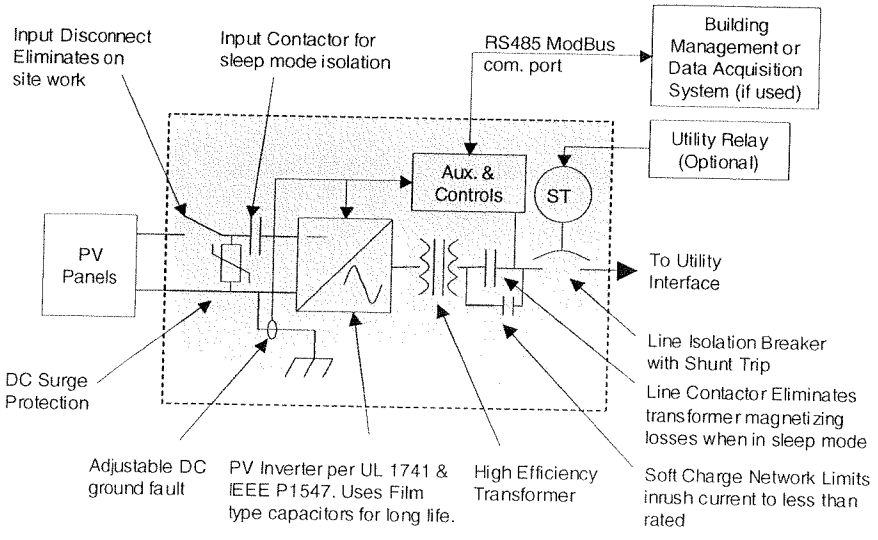
SATCON Power Systems

POWERGATE™ Photovoltaic 50kW Power Converter System

Model AE-50-60-PV Specifications:

Rated output:	50 kW
AC Voltage Range:	+/-10% Vnom., 60Hz
Model Voltage Suffix	A F D E
AC Rated Voltages:	480V 240V 208V 120/240V
Phases:	3 3 3 1
AC Rated Currents:	60A 120A 138A 208A
Nominal DC:	400 Volts, 160A rms max with programmable current limit, 190Apk.
Min DC input for Rated kW:	330 Vdc @ nom. line
Power Tracking Window:	280 to 660 VDC
Current Harmonics:	<3% THD
Min Power for Wake/Sleep:	500W
Peak Inverter Efficiency:	96.0%
Peak System Efficiency:	94.5%
Weighted System Efficiency:	93% as per CEC
Max. Heat Dissipation	2.75kW at 50kW delivery
Enclosure type:	NEMA 1 and NEMA 3R, Seismic Zone 4, 11 gauge steel
Dimensions: (h x w x d)	1780 x 1020 x 610 mm (70 x 40 x 24in)
Weight:	1800lbs, 820kg
Humidity: (relative)	95% (non-condensing)
Ambient Temp:	-20 to +50°C (-4 to 122°F) @ 6000ft.
Storage Temp:	-40 to 85°C (-40 to 185°F)
Array Configuration:	Monopole grounded (See Other Options)
AC Line Terminals	M10 (3/8") h/w on 1" Bus
DC Terminals	2 X M10 (3/8") h/w
UL1741 certified & CEC listing	Model AE-50-60-PV-A

PowerGate™ Power Conversion System



Standard Features
Maximum peak power tracking
Overload on temperature permit
DC & AC voltage surge protection
Adjustable DC ground fault
Event log in non volatile memory
NC contact for AC line breaker trip
Automatic:
Wake up / sleep sequencing
Grid synchronization
Reconnect on grid restoration
Local & Remote Monitoring:
Grid status
DC input power
DC input voltage
DC input current
Line kVAR
Line kW
Line kVA
Line kWHr.
Power Factor
Three Line to Neutral Voltages
Three Line + Neutral Currents
Protection & Diagnostics:
Emergency stop
Control & power supply fault
Inverter over current
Input Over Voltage
Door open
Fan fault
Blown Fuse
Contactor Fault
Magnetics Over Temperature
Inverter Over Temperature
Line over/under voltage & frequency
Line & Neutral over current
Gating fault
Options:
3 p fused combiner. (-ve gnd.)
Various external combiners
2 pole DC disc. (Floating or center grounding available)
50 Hz & various line voltages
Condensation limiting heater
Higher Breaker interrupt ratings
CE certification
Consult factory for other options

SatCon Power Systems, A division of SatCon Technologies Phone 905-639-4692 Fax 905-639-0961 Email: powersystems.sales@satcon.com

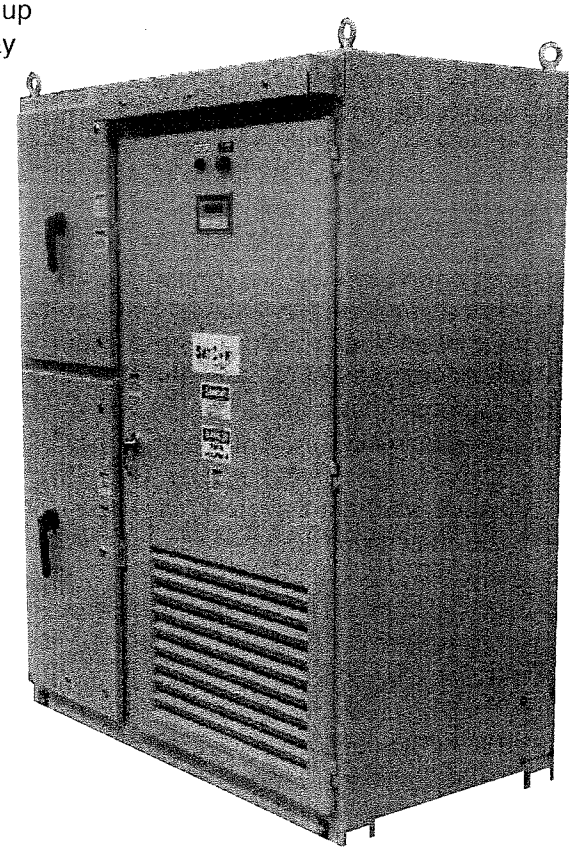
SATCON
Power Systems

POWERGATE™ Photovoltaic 135kW Power Converter System

SatCon's **PowerGate™** power converter for photovoltaic applications (AE-PV Series), available in both 208 Volt and 480 Volt versions is a 135 kW grid-tie interactive inverter designed to convert power generated by PV arrays into utility grade power for export to the utility grid.

PowerGate™AE-PV Series Features

- Fully integrated system, Complete electrical conversion installation in one box
- Intelligent wake up and sleep algorithms at dusk and dawn squeeze out maximum kWhr exported
- Use of film capacitors increases life up to four times over electrolytic capacitors used by others
- Low sleep mode power consumption increases net energy delivered to the grid
- Field wiring compartments reduce installation time and cost. No field interconnect between components
- Filtered top air entry/bottom exhaust reduces debris blockage
- Soft charge network limits AC inrush on system wake up
- Highest overall efficiency available on the market today
- Wider input Voltage range
- Highly accurate peak power tracking, increases overall energy produced
- Smaller overall system footprint
- DC Contactor quickly isolates any faults that may occur on PV cabling.
- AC Line contactor isolates high efficiency transformer from the grid in sleep mode
- Full system monitoring and metering via front panel display and RS232/485 communication port.
- Approved Built-In Metering accuracy better than ± 1%
- Discharge contactor removes stored energy on DC bus for customer safety
- Sloped roof prevents standing water
- Top, bottom and side cable entries



System Includes:

- High efficiency isolation transformer
- Input disconnect & contactor
- AC line breaker & contactor
- Generating Power indicator
- Keypad with alpha-numeric four-line display
- Top lifting eye-bolts
- DC surge protection

SatCon's power converter software has been UL1741 certified for a number of grid-connect alternative energy applications. The AE-PV **PowerGate™** series power converter is designed to meet the requirements of IEEE1547, UL 1741 and CEC. This ensures safe, reliable grid connection with **PowerGate**'s™ certified software for anti-island detection.

SATCON Power Systems

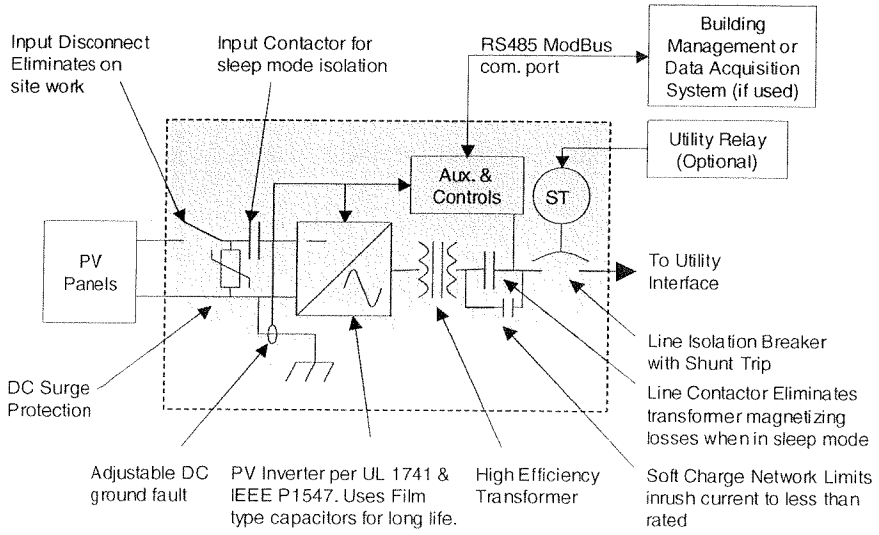
POWERGATE™ Photovoltaic 135kW Power Converter System

Model AE-100-60-PV Specifications:

Rated output:	135 kW		
AC Voltage Range:	+/-10% Vnom., 60Hz		
Model Voltage Suffix	A	F	D
AC Rated Voltages:	480V	240V	208V
Phases:	3	3	3
AC Rated Currents:	162A	324A	373A
Nominal DC :	400 Volts, 432A rms max with programmable current limit, 513Apk.		
Min DC input for Rated kW:	330 Vdc @ nom. line		
Power Tracking Window:	280 to 660 VDC		
Current Harmonics:	<3% THD		
Min Power for Wake/Sleep:	1000W		
Peak Inverter Efficiency:	97%		
Peak System Efficiency:	96%		
Weighted System Efficiency:	94.5%		
Max. Heat Dissipation	5.4kW at 100kW delivery		
Enclosure type:	NEMA 1 and NEMA 3R, Seismic Zone 4, 11 gauge steel		
Dimensions: (h x w x d)	1880 x 1520 x 762 mm (74 x 60 x 30in)		
Weight:	4400lbs. 2000kg		
Humidity: (relative)	95% (non-condensing)		
Ambient Temp:	-20 to +50°C (-4 to 122°F) @ 6000ft.		
Storage Temp:	-40 to 85°C (-40 to 185°F)		
Array Configuration:	Monopole grounded (See Other Options)		
AC Line Terminals	M10 (3/8") h/w on 1½" Bus		
DC Terminals	400MCM-#4		
Certification:	UL 1741 pending		

Standard Features
Maximum peak power tracking
Overload on temperature permit
DC & AC voltage surge protection
Adjustable DC ground fault
Event log in non volatile memory
NC contact for AC line breaker trip
Automatic:
Wake up / sleep sequencing
Grid synchronization
Reconnect on grid restoration
Local & Remote Monitoring:
Grid status
DC input power
DC input voltage
DC input current
Line kVAR
Line kW
Line kVA
Line kWHr.
Power Factor
Three Line to Neutral Voltages
Three Line + Neutral Currents
Protection & Diagnostics:
Emergency stop
Control & power supply fault
Inverter over current
Input Over Voltage
Door open
Fan fault
Blown Fuse
Contactor Fault
Magnetics Over Temperature
Inverter Over Temperature
Line over/under voltage & frequency
Line & Neutral over current
Gating fault
Options:
6 p fused combiner. (-ve gnd.)
Various external combiners
2 pole DC disc. (Floating or center grounding available)
50 Hz & various line voltages
Condensation limiting heater
Higher Breaker interrupt ratings
CE Certification
Consult factory for other options

PowerGate™ Power Conversion System



SatCon Power Systems, A division of SatCon Technologies Phone 905-639-4692 Fax 905-639-0961 Email: powersystems.sales@satcon.com

TABLE 1

Sub-Array Details					
Project	Sub-Array	Mount Type	Tilt-Up Angle	Qty Modules	kW (stc)
Fire Station	FS-1	A	5	144	24.5
	FS-2	A	5	18	3.1
	FS-3	A	5	6	1.0
	FS-4	A	5	24	4.1
	FS-5	A	5	24	4.1
	FS-6	A	5	24	4.1
	FS-7	B	flush	48	8.2
	FS-8	A	10	24	4.1
	FS-9	C	flush	12	2.0
				324	**55.1**
City Hall	CH-1	A	10	72	12.2
	CH-2	A	10	36	6.1
	CH-3	B	flush	36	6.1
	CH-4	D	flush	60	10.2
	CH-5	D	flush	48	8.2
	CH-6	D	flush	60	10.2
	CH-7	D	flush	204	34.7
	CH-8	D	flush	60	10.2
	CH-9	D	flush	60	10.2
	CH-10	D	flush	60	10.2
	CH-11	D	flush	60	10.2
	CH-12	D	flush	60	10.2
				816	**138.7**
Library	LIB-1	A	10	60	10.2
	LIB-2	A	10	12	2.0
	LIB-3	B	flush	36	6.1
	LIB-4	A	5	10	1.7
	LIB-5	A	5	20	3.4
	LIB-6	A	5	6	1.0
	LIB-7	D	flush	72	12.2
				216	**36.7**
Senior Center	SC-1	A	5	180	30.6
	SC-2	A	5	36	6.1
				216	**36.7**

SHARP

SHARP ELECTRONICS CORPORATION
PHOTOVOLTAIC MODULE LIMITED WARRANTY

Sharp Electronics Corporation warrants to the first consumer purchaser that this Sharp brand product (the "Product"), when shipped in its original container, will be free from defective workmanship and materials, and agrees that it will, at its option, either repair the defect or replace the defective Product or part thereof with a new or remanufactured equivalent at no charge to the purchaser for parts or labor for the period(s) set forth below.

This warranty does not apply to any appearance items of the Product nor to the additional excluded item(s) set forth below nor to any Product the exterior of which has been damaged or defaced, which has been subjected to misuse, abnormal service or handling, or which has been altered or modified in design or construction.

In order to enforce the rights under this limited warranty, the purchaser should follow the steps set forth below and provide proof of purchase to the servicer.

The limited warranty described herein is in addition to whatever implied warranties may be granted to purchasers by law. ALL IMPLIED WARRANTIES INCLUDING THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR USE ARE LIMITED TO THE PERIOD(S) FROM THE DATE OF THE PURCHASE SET FORTH BELOW. Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you.

Neither the sales personnel of the seller nor any other person is authorized to make any warranties other than those described herein, or to extend the duration of any warranties beyond the time period described above on behalf of Sharp.

The warranties described herein shall be the sole and exclusive warranties granted by Sharp and shall be the sole and exclusive remedy available to the purchaser. Correction of defects, in the manner and for the period of time described herein, shall constitute complete fulfillment of all liabilities and responsibilities of Sharp to the purchaser with respect to the Product and shall constitute full satisfaction of all claims, whether based on contract, negligence, strict liability or otherwise. In no event shall Sharp be liable, or in any way responsible, for any damages or defects in the Product which were caused by repairs or attempted repairs performed by anyone other than an authorized servicer. Nor shall Sharp be liable or in any way responsible for any incidental or consequential economic or property damage. Some states do not allow the exclusion of incidental or consequential damages, so the above exclusion may not apply to you.

THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS. YOU MAY ALSO HAVE OTHER RIGHTS, WHICH VARY FROM STATE TO STATE.

Product Model Number & Description:

NT-S5E1U, NT-185U1, NT-R5E1U, NT-175U1, ND-208U1, ND-205U1, ND-167U1, ND-167U3, ND-167U3A, NE-170U1, NE-Q5E2U, NE-165U1, ND-162U1, ND-160U1Z, ND-160U3, ND-L5E1U, ND-L3E1U, ND-L3EJE, ND-L3EJEA, ND-60RU1, ND-62RU1, NE-80E1U, NE-80EJE, NE-80EJEA, ND-Q0E2U, ND-N6E1U, ND-N2ECU, ND-N0ECU, NE-K125U2, ND-72ELU, ND-72ERU, ND-70ELU, ND-70ERU
(Be sure to have this information available when you need service for your product.)

SHARP ELECTRONICS CORPORATION
Sharp Plaza, Mahwah, New Jersey 07430-2135

SHARP

Warranty Period for this Product:

The warranty period for material defects and workmanship is one year from date of purchase. The warranty period with respect to power output continues for a total of 25 years from date of purchase, the first 10 years at 90% minimum rated power output and the balance of 15 years at 80% minimum rated power output.

This warranty is transferable when product remains installed in original location at the time of product warranty registration.

Additional Item(s) Excluded from Warranty Coverage

Warranty coverage does not apply when:

a) the Product is improperly installed,
b) the Product is installed in a mobile or marine environment, subjected to improper voltage or power surges or abnormal environmental conditions (such as acid rain or other pollution),
c) the components in the construction base on which the module is mounted are defective
d) external corrosion, mold discoloration or the like occurs.

Where to Obtain Service:

Warranty service is available at a Sharp Authorized Dealer located in the United States. To find the location of the nearest Sharp Authorized Dealer, call Sharp toll free at 1-800 SOLAR06 (800-765-2706).

Call toll free at 1-800-765-2706 to obtain a Return Authorization Number and shipping instructions. **Proof of Purchase** will be required.

What to do to Obtain Service:

Ship prepaid or carry in your Product to a Sharp Authorized Dealer. Be sure to have **Proof of Purchase** available. If you ship the Product, be sure it is insured and packaged securely. Sharp will not be responsible for the costs of de-installation or reinstallation.

SHARP ELECTRONICS CORPORATION
Sharp Plaza, Mahwah, New Jersey 07430-2135